Gamma irradiation effect on structural and optical properties of Bismuth-Boro-Tellurite glasses

ABSTRACT

The changes of the optical and structural properties of Bismuth-Boro-Tellurite glasses pre and post gamma irradiation were studied. Six glass samples, with different composition [(TeO2)0.7 (B2O3)0.3]1-x (Bi2O3)x prepared by melt quenching method were irradiated with 25kGy gamma radiation at room temperature. The Fourier Transform Infrared Spectroscopy (FTIR) was used to explore the structural bonding in the prepared glass samples due to exposure, while UV-VIS Spectrophotometer was used to evaluate the changes in the optical properties before and after irradiation. Gamma irradiation causes profound changes in the peak intensity as shown by FTIR spectra which is due to the breaking of the network bonding. Before gamma irradiation, the optical band gap, Eg value decreased from 2.44 eV to 2.15 eV with the addition of Bismuth content. The value kept decreasing (from 2.18 eV to 2.00 eV) following exposure to gamma radiation due to the increase of non-bridging oxygen (NBO) and the increase of defect in the glass. In conclusion, the glass with high content of Bi2O3 (0.30Bi) give smallest Eg and show less changes in FTIR spectra after gamma irradiation which indicate that this glass is more resistant to gamma radiation compared to other glasses.

Keyword: Gamma radiation; Bismuth; Boro-tellurite; Optical properties